weight of the sweep. After the connecting groove had been completed, another difficulty arose due to the flange called for at each side of this groove. If the groove were continued on the same pitch, one of these flanges would be cut away. The only solution of the difficulty was to change the pitch for the first turn of the groove on the upper drum face. The thickness of the flange called for was one inch. Hence, a worm of 3⅝-inch pitch was made and secured to the spindle. One turn was then made with this pitch after which the remainder of the groove was struck up with board 7, which was operated like board 4 on a 2⅝-inch pitch.

The spindle was now removed and the mold or "cope," as it is called, was lifted from the "drag" or bed. This was done by making fast to lugs on the lifting ring. The grooves were smoothed up and blackened, then treated with a coat of molasses water and lead and the mold was finally baked. The other details of the operation need no explanation. The core was swept in segments of one-sixth of a circle and pieces were bolted onto the sweep which could be taken off when a core was made so as to get the proper thickness at the connecting groove. The total weight of the casting was 7 tons.

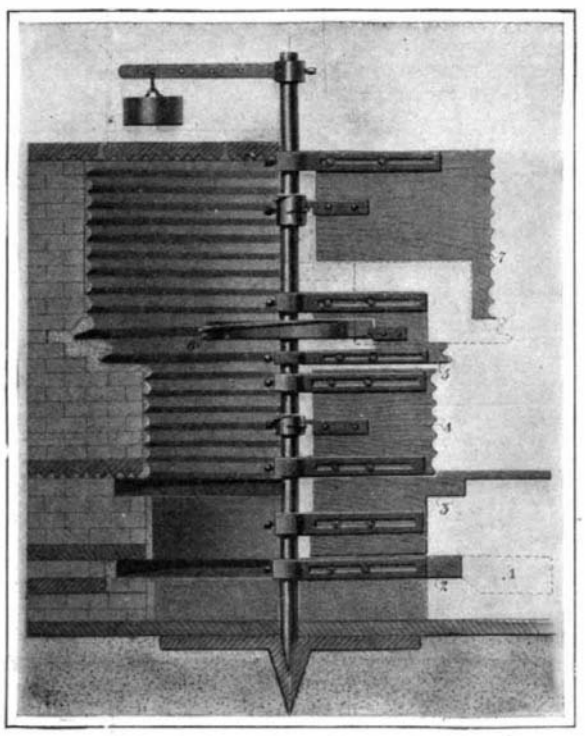
THE WALSCHAERT VALVE ON AMERICAN LOCOMOTIVES

America's contribution to the development of the steam locomotive during the past twenty-five years has consisted chiefly in a very successful effort to develop its power and keep pace with the ever-increasing demand imposed by heavier rolling stock and longer trains. Only those who have closely observed the growth of the locomotive have any idea of the extent to which its hauling power has been increased; and for many years past we have been far in the van among the great locomotive builders of the world in this one particular. We were the first to insist upon the fact that, whatever changes and improvements might be made in cylinders and general running gear, whatever type of driving-wheel arrangement might be used, the ultimate factor that will determine hauling capacity is boiler power. The result is that to-day, in spite of the fact that foreign builders have followed our lead and are everywhere increasing the size of their locomotive boilers, it is in this country that the most powerful engines are to be found. In the great mountain-climbing locomotive, now at work on the Baltimore & Ohio Railroad, which is capable of exerting a tractive effort of 42 tons at starting, and from 30 to 37½ tons at moderate speed, we have a locomotive which is not only by far the most powerful in existence, but has proved itself, in spite of its enormous weight and many novelties of design, to be an exceedingly satisfactory investment.

At the same time, in our effort to obtain power we have rather neglected the question of efficiency, whether it be sought in the direction of details of boiler design, in the use of superheaters, or in the refinement of the valve gear. This matter, however, is now receiving the attention of the master mechanics of our railroads and our leading locomotive builders. A notable improvement, which is making its way quickly in favor, is the introduction of the famous Walschaert valve gear, which has been doing such splendid work on continental railroads. It forms the characteristic feature in the handsome locomotive which we herewith illustrate, which has recently been put in service by the Pennsylvania Railroad Company, and assigned to the important duty of hauling the crack eighteen-hour train of that company that runs daily between New York and Chicago. A study of the on the same general lines as its predecessors. It is a simple engine with two outside cylinders 22 inches in diameter by 26 inches stroke, connected to four coupled driving wheels 80 inches in diameter. The boiler is run under a working pressure of 205 pounds to the square inch. The maximum tractive effort at starting is 25,800 pounds.

The Walschaert gear is not by any means a new device; in fact, it belongs to the earliest days of locomotive history, having been in use since the year 1844. About 90 per cent of the main line locomotives on the continent of Europe are equipped with it, and it was shown on twenty-five out of thirty-one locomotives exhibited at the Liége Exposition. As compared with the Stephenson gear, there are some advantages of steam distribution and control; but it is equally, if not more, on account of the advantages which it offers from a constructive and operative point of view that it has won its way to recognition by the leading manufacturers. It is more accessible than the Stephenson gear, especially on large locomotives on which the eccentrics are necessarily crowded and difficult to get at except when the locomotive is over a pit. Also in a heavy passenger engine there is a saving of as high as 1,745 pounds over the Stephenson gear. The Walschaert gear is also more direct in its action, the power being transmitted to the valve in comparatively straight lines instead of by rocker arms, shafts, etc., which are more or less yielding and liable to spring. It avoids the wear which is involved in the use of large eccentrics, to say nothing of the lost motion resulting from the rapid deterioration that occurs in the Stephenson links. Incidentally, moreover, the removal of the valve gear to the outside of the frames renders it possible to give the latter more efficient bracing.

A Double-Grooved Drum and Cam Used in Striking Up the Mold.



Method of Striking Up the Mold.

A PUZZLING BIT OF FOUNDRY WORK.

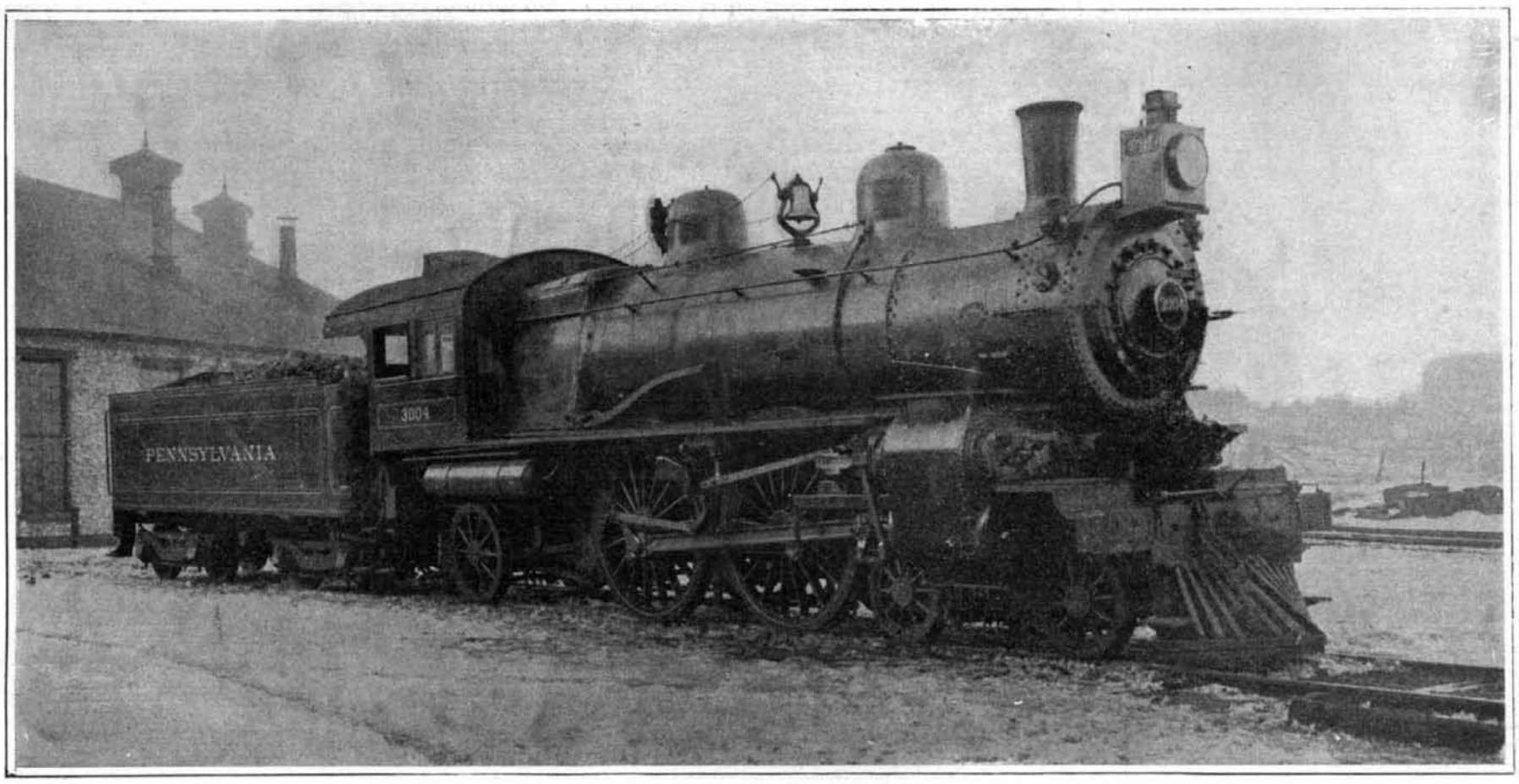
photograph shows how the motion is transmitted from a supplementary crank on the outside of one of the driving axles to the valve. Those who are familiar with the Atlantic type of express engines which have been hauling the fast trains on this system for the past few years will see that the new engine, except for the valve-gear connections, is built

Phototegy.—Something New in Photography.

"The Illustration (Paris) describes as follows a very curious process of photographic development called 'phototegy' (from the Greek signifying 'to dye'). Cleansing the plates with oxygenated water had already been tried, but the results obtained were both slow and irregular. The following formula expedites and regulates the action peculiar to this liquid, which is to remove from the negative thicknesses of gelatine proportionate to the opacity of the parts reduced, i. e., attacked by the light:

Water	100 cc.
Muriatic acid	10 cc.
Bioxide of barium	4 gr.

"We should exclude too astringent developers, and employ by preference ferrous oxalate or diamidophenol. After development and washing, the glass is placed in the solution of oxygenated water (in broad daylight, if we wish). The blacks come off in a few minutes, and we obtain directly a foundation composed of reliefs. The picture naturally absorbs quantities of coloring liquid proportionate to the thicknesses of the gelatine. We may then by a subsequent dipping give to the plate the hue that we desire; we shall be able, further, to obtain proofs of it upon paper by simple contact. Finally, in coloring the plate by brush with uniform tints the handling of the shades will be obtained automatically."



NEW PENNSYLVANIA EXPRESS LOCOMOTIVE FITTED WITH WALSCHAERT VALVE GEAR.

Cylinders, 22 inches diameter by 26 inches stroke. **Drivers,** 80 inches diameter. **Steam pressure,** 205 pounds. **Maximum tractive effort,** 28,500 pounds.